

LV.—*Phenomena of Autotomy in Phasmidæ belonging to the Genera Monandroptera and Rhaphiderus.* By EDMOND BORDAGE*.

THE islands of Réunion and Mauritius possess two splendid Phasmidæ belonging to the genera *Monandroptera* and *Rhaphiderus*—*M. inuncans*, Serville, and *R. scabrosus*, Serv. (*Monandroptera spinigera*, Lucas).

In the case of the former species the female is apterous and attains a length of 20 centim. by 25 millim. in breadth; its colour is brown or grass-green. The male, which is greenish grey or green and less clumsy in shape, does not exceed 17 centim. in length by 18 millim. in breadth; it possesses very rudimentary elytra, of the colour of the body, and fairly long wings tinged with pale rose and brown, and having an opaque green margin.

The dimensions of the specimens of *Rhaphiderus scabrosus* are considerably less; the female, which is brown or a magnificent grass-green, attains a maximum size of 8·5 centim. in length by 11 millim. in breadth and is devoid of wings. The male, which is likewise apterous, assumes a brown hue and resembles a little twig. It is but 6·5 centim. in length and does not exceed 5 millim. in breadth.

A few months ago, having succeeded in obtaining a few of these curious Orthoptera, I inadvertently left a *Monandroptera* upon a laboratory table. A moment or two later the insect, which was lying upon its back, had lost its two front legs, and I found to my astonishment that I was confronted with phenomena of autotomy, brought about by two specimens of *Plagiolepis longipes*, Forel. (This is an ant which belongs to India, and was introduced a few years ago by means of ships into Mauritius and Bourbon, where it has invaded the dwellings on the coast.) The severance was produced between the femur and the trochanter †; the cut was as clean as

* From the 'Comptes Rendus,' t. cxxiv. no. 7 (Feb. 15, 1897), pp. 378–381: from a separate impression communicated by the Author.

* The trochanter and femur, instead of being united by an articulation allowing of their movement one on the other, are, on the contrary, fused together. It was only after I had discovered the phenomena of autotomy that I noticed this fusion, which is, however, indicated by a little groove. After autotomy the portion that still remains attached to the body comprises the coxa, united by the arthrodial membrane to a little ring or cushion, which is nothing but the trochanter separated from the femur by the neatest of circular fractures. This fusion, therefore, of the trochanter and thigh, or femur, strongly reminds us of that which we observe in the crabs between the basipodite and ischiopodite.

possible, and the loss of blood had been insignificant. The ants succeeded once more in separating a third limb under my very eyes, and there the process stopped. I repeated the experiment, and always with success; but in one solitary case, in which the victim was a female *Monandroptera*, I was able to remark the rupture of the whole of the limbs. The anterior legs, where the base of the femur is greatly attenuated, are usually those in which the ants most easily succeed in producing autotomy.

The ants do not work by pulling, but, in truth, by bites inflicted upon the interarticular membrane, between the coxa and the trochanter, or between the femur and the tibia. The action of a single ant is sometimes sufficient. In certain cases autotomy takes place immediately, in others a certain time elapses between the infliction of the bite and the moment when amputation ensues. Thus, after having observed the presence of ants upon the limbs of a Phasmid, it has happened that I have picked up the insect, carefully avoiding seizing it by the legs, in order to remove it from the action of its aggressors. Under these conditions I have sometimes seen autotomy take place four or five minutes after the bite. It also occurred sometimes when I lifted the insect gently, without shaking or squeezing it, by one of the legs upon which I had observed the ants inflicting their bites a few moments before. Without the least muscular contraction the insect abandoned its leg and fell.

Formic acid therefore has a very powerful action, readily provoking autotomy.

With few exceptions it was only with real difficulty that I was able to bring about autotomy in adult specimens of *Rhaphiderus* and *Monandroptera*—a result produced by the ants with ease, in the case of two or three limbs at any rate.

The exceptions were provided chiefly by *Rhaphiderus*. In certain cases, on holding the insect suspended by a limb and exerting, by means of the finger-nails, strong pressure upon the median region of the femur, I have succeeded in producing autotomy; the phenomenon was reproduced in the same manner in the case of the five other legs. I have succeeded in arriving at the same result by inflicting burns or cuts towards the distal region of the femur.

I met with more difficulty in the case of the *Monandroptera*. It was the utmost I could do if, in a few specimens, I succeeded in causing the detachment of two or three limbs.

Very often I found it impossible to produce a single case of autotomy in either of the two species. It is to be noted that I am speaking here of specimens observed in full vigour;

in spite of this my attempts remained fruitless, albeit I employed the most energetic methods—rapid cuts, inflicted in succession upon the same femur; then the effect of burning, until the limb was reduced to a simple stump. Sometimes I lifted the insect by this stump and shook it violently. The result of this was a tearing of the membrane situated between the thorax and the coxa, or, more often, of that which unites the coxa to the trochanter. This tear presented very irregular contours, with a bunch of muscular fibres detached by the tension.

I must further make mention of the longer or shorter interval that elapses between the production of the stimulus and the detachment of the limb. This interval, which is sometimes less than one second, may also extend to as much as ten minutes.

To recapitulate: autotomy is clearly exhibited in the case of *Monandroptera inuncans*, and especially in *Rhaphiderus scabrosus*, but in an irregular, or even, one might say, in a capricious fashion. The limbs belonging to the anterior pair are usually those which most readily become detached. In these insects, however, autotomy is never produced so easily as in the saltatory Orthoptera, such as the grasshoppers, whose great posterior legs always detach themselves so quickly when the femur is pinched, even very slightly, or when it is suddenly cut through. Lastly, while in the case of the grasshopper it is the contraction of a single muscle or of a small number of muscles that causes the rupture, in the Phasmidæ the latter takes place only after very vigorous muscular contractions affecting the entire body. These contractions are more violent in the females than in the males. In the enormous heavy females of *Monandroptera inuncans* especially they are very remarkable, and in such cases there sometimes takes place, after the rupture, a loss of blood more considerable than usual, represented by a large greenish drop. This hæmorrhage, although arrested pretty quickly by coagulation, is nevertheless sufficient, if it again ensues owing to the loss of three or four other limbs, to cause flaccidity of the body and the death of the insect after an interval of from twelve to twenty hours.

When autotomy is produced by the bite of the ants it may be followed by hæmorrhage if the insect be abandoned to its aggressors for a few minutes, since, by their repeated bites inflicted upon the raw wound, they prevent the coagulation of the blood.